

**BEHAVIORAL AND EMOTIONAL PROBLEMS IN CHILDREN WITH POOR MOTOR SKILLS: ACCORDING TO PARENTAL EMIC PERCEPTION****SINTOMAS COMPORTAMENTAIS E EMOCIONAIS EM CRIANÇAS COM BAIXA COMPETÊNCIA MOTORA: SEGUNDO A PERCEPÇÃO ÊMICA PARENTAL**

Pâmella Medeiros<sup>1</sup>, Marcela Almeida Zequinão<sup>1</sup>, Walan Robert Silva<sup>1</sup>, Isabely Rúbila Maciel<sup>1</sup> and Fernando Luiz Cardoso<sup>1</sup>

<sup>1</sup> Santa Catarina State University, Florianópolis-SC, Brazil.

**RESUMO**

A baixa competência motora pode estar associada a incidência de problemas com a saúde mental, principalmente no que diz respeito a desfechos sociais, comportamentais e emocionais. O objetivo deste estudo foi analisar a associação dos sintomas emocionais e comportamentais com competência motora em escolares de 7 a 10 anos. Para isso, foram avaliadas 439 crianças (242 meninas e 197 meninos). As variáveis foram mensuradas com o Movement Assessment Battery for Children, 2nd ed. (MABC-2) e Strengths and Difficulties Questionnaire (SDQ). Os resultados indicaram que crianças com baixa competência motora tiveram mais chances de terem desenvolvimento anormal no que se refere aos sintomas emocionais e comportamentais, quando comparada às crianças do grupo referência. Dessa forma, dados empíricos como estes podem auxiliar na conscientização pública e profissional, tendo em vista as consequências sociais e psicológicas da baixa competência motora, além dos custos individuais advindos dos problemas de saúde mental.

**Palavras-chave:** Sintomas emocionais. Sintomas comportamentais. Crianças

**ABSTRACT**

Poor motor skills may be associated with the incidence of problems with mental health, especially with regard to social, behavioral, and emotional outcomes. The aim of the current study was to analyze the association of emotional and behavioral problems with motor skills in students aged 7 to 10 years. For this, 339 children (187 girls and 152 boys) were evaluated. The variables were measured using the Movement Assessment Battery for Children, 2nd ed. (MABC-2) and the Strengths and Difficulties Questionnaire (SDQ). The results indicated that children with poor motor skills were more likely to present abnormal development in terms of emotional and behavioral problems when compared to children from the reference group. Thus, empirical data such as these can assist in raising public and professional awareness, considering the social and psychological consequences of poor motor skills, in addition to the individual costs arising from mental health problems.

**Keywords:** Emotional problems. Behavioral problems. Motor skills. Child.

**Introduction**

According to the World Health Organization – WHO<sup>1</sup> there is no official concept for “mental health”, as it differs according to different cultures and subjective judgments related to it. However, it is known that mental health is an integral and essential part of health, and in general, it is characterized not only by the absence of mental disorders, but also by the internal balance and demands and external experiences of the individual. Feeling good about yourself, having the ability to deal with emotions, having positive attitudes towards yourself and others, and self-determination and social competence are aspects identified as criteria for satisfactory mental health<sup>1</sup>.

In contrast, mental health difficulties include emotional problems - symptoms of anxiety, depression, social relationship problems - and behavioral problems - associated with hyperactivity and inattention, conduct problems such as lies, disobedience, difficulties in accepting rules, and selfish and insensitive feelings<sup>2</sup>. Although rarely diagnosed, these problems are common during childhood<sup>3-5</sup> and less than half of affected children receive adequate treatment.<sup>6</sup>

In order to avoid the early appearance of mental health problems, it is essential to understand the risk factors that can affect the development of these problems<sup>7</sup>. Among them, motor skills can be mentioned, defined as the ability to perform precise and coordinated movements in a wide range of motor abilities, and essential for the psychosocial development of children<sup>8,9</sup>. Thus, evidence examines the co-occurrence between impairment in motor skills and the incidence of mental health problems, especially with regard to social, behavioral, and emotional outcomes<sup>10,11</sup>. These findings point to the potential impact of motor skills in many areas of a child's life<sup>6</sup>. For example, children with low motor skills may have difficulties with schoolwork<sup>11,12</sup>, be less likely to participate in group activities<sup>13</sup>, and present relationship difficulties<sup>14, 15</sup>, as well as risks for symptoms of anxiety<sup>16</sup> and depression<sup>10</sup>.

In the study by Green, Baird, and Sugden<sup>17</sup>, the authors reported that 62% of children with poor motor skills presented abnormal levels of emotional and behavioral problems. In addition, 85% of the sample presented significant problems in at least one of the five scales of the Skills and Difficulties Questionnaire - SDQ, which include emotional problems, conduct problems, hyperactivity and inattention, relationship with peers, and pro-social behavior. The study by Hill et al.<sup>18</sup>, with a normative sample, that is, without diagnosis, of 298 children aged 4 to 11 years, also revealed that there is a clear relationship between motor proficiency and mental health. Similarly, the longitudinal study by Lingam et al.<sup>10</sup>, with a sample of 6902 children, showed that participants with Developmental Coordination Disorder - DCD presented an increased risk of mental health difficulties when compared to their peers without DCD.

However, the majority of the evidence supporting this relationship comes from studies with clinical samples, usually in children with DCD or Attention Deficit Hyperactivity Disorder - ADHD<sup>19,12</sup>, which makes it difficult to generalize the data, limiting the awareness of potential mental health difficulties in individuals with poor motor skills. For Hill et al.<sup>18</sup>, the influence of motor skills on child development is “neglected” or “hidden” and is underestimated by education and health professionals. It is also worth noting that there may be an interdependent relationship between these variables, generating a feedback loop of low motor skills and behavioral and emotional problems, in which one variable affects the other mutually. Taking into account the problematization of this theme, it is essential to clearly understand this complex association, as in this way, intervention and prevention strategies can be considered. Therefore, in view of the evidence and considering the great impact that motor proficiency can have on the life and integral development of a child, the current study aims to analyze the association of emotional and behavioral problems with motor skills in students aged 7 to 10 years.

## Methods

### *Sample*

This study involved 339 children (187 girls and 152 boys) with ages ranging between seven and 10 years ( $8.97 \pm 1.03$ ), all recruited from a large public school in the city of Florianópolis, State of Santa Catarina, Brazil. The selection of the school was intentional, as it took into account the high number of students who met the premise of the project, children aged 7 to 10 years. The only exclusion criterion adopted was: children with a motor or cognitive disability that made it impossible for them to carry out the assessments, and these children were indicated by the teaching coordination. However, all children were invited to participate in the research, and those who were included in the exclusion criteria were removed from the analysis of the results. This study was approved by the ethics committee in research with human beings under opinion no. 2,209,766. Participants were duly informed

about the research and expressed their consent through the Term of Assent (TA). In the same way, a Free and Informed Consent Term (ICT) was prepared, in which the consent of the legal guardian for the child is made explicit. This document contained information relevant to the research and the researchers involved.

With regard to socioeconomic characteristics, participants were homogeneous, in which 74% of participants were classified as belonging to social class "C" and 53.8% of children with low motor skills are male.

### *Instruments*

The Movement Assessment Battery for Children Second Edition MABC 2<sup>20</sup>, is one of the most commonly used instruments to identify motor difficulties in children and adolescents aged 3 to 16 years. The MABC is a test consisting of three sets of tasks appropriate for specific age groups: Age Band 1 (3 to 6 years); Age Band 2 (7 to 10 years), and Age Band 3 (11 to 16 years). Herein, only the Age Band 2 set was used. The skills assessed by the motor battery are Manual Dexterity, Throwing/Receiving, and Balance (static and dynamic) and for each age group different tasks are established with different complexities. Children with results below or equal to the 5th percentile receive an indication of significant movement difficulties; values between the 5th and 15th percentile indicate that the child is at risk for movement difficulties, requiring developmental monitoring (borderline); and values equal to or greater than the 16th percentile indicate that the child has no movement difficulties, being part of the reference group. In the current study, children below the 16th percentile were categorized as presenting low motor skills<sup>21,22</sup>.

The Strengths and Difficulties Questionnaire - SDQ is a questionnaire used worldwide to screen for behavioral problems in children and adolescents aged 4 to 16 years, based on responses from parents and/or teachers<sup>23</sup>. The SDQ was translated and adapted to Portuguese by Fleitlich<sup>24</sup>, and data on the validity and reliability of the SDQ in Brazil were described by Woerner et al<sup>25</sup>. The SDQ consists of 25 items, divided into five subscales, each consisting of five items, with four scales representing emotional symptoms (symptoms of depression and anxiety - and peer relationships) and behavioral symptoms (hyperactivity and inattention and conduct problems), and one scale assessing pro-social behavior. The answers are based on behavior in the previous six months, and the respondent is required to choose one of three options, namely: "false (zero points)", "more or less true (one point)", or "true (two points)".

The sum of all items corresponding to the 4 problematic behavior scales represents the child's Total Difficulties (minimum 0 and maximum 40 points). The results for each of the scales are obtained by the sum of the items of each scale and allow the classification of the child into three categories: 0-13 points - normal development (ND), 14-16 borderline (BD), or 17-40 abnormal (AD). In addition, it is also possible to classify each of the scales according to this categorization.

For the socioeconomic characterization of the participants, the Criterion Brazil questionnaire for socioeconomic classification - ABEP was used. The participant checks the number of items they have at home (bathrooms, domestic servants, automobiles, microcomputers, dishwashers, refrigerators, freezers, washing machines, DVDs, microwaves, motorcycles, clothes dryers), the level of education of the head of the family (illiterate/incomplete primary school; complete primary school/incomplete secondary school; complete secondary school/ incomplete high school; complete high school / incomplete university education; complete university education) and the public services available to them (piped water and paved street), the participant receives a score which

classifies their economic situation as follows: Class A: 45-100 points; Class B1 – B2: 20-38 points; Class C1, D, and E: 0-28 points.

### *Procedures*

Firstly, the motor skills of participants were evaluated, individually. The children were instructed to wear light clothing for the individual testing using the MABC-2 motor battery. This stage was carried out in a school environment, by two evaluators, in spaces provided by the school, and there were no interruptions during the evaluations.

The analyses of emotional and behavioral problems were carried out by means of a telephone interview with the parents and/or guardians of the participants, and all interviews were conducted by only one evaluator. A questionnaire referring to socioeconomic characterization was sent to parents and guardians, however, only 233 questionnaires were answered (31.27%). All researchers were trained to administer all tests prior to the evaluations.

### *Statistical analysis*

For data analysis, first, descriptive statistics (mean, standard deviation, and frequency distribution) were used to characterize the study variables. Regarding inferential statistics, the chi-square test was performed to verify possible associations between motor skills with sex and socioeconomic status. In addition, the Kolmogorov Smirnov normality test was used to verify that the data met the parametric assumptions. As the data did not present normal distribution, the Mann-Whitney U test was used to compare children with poor motor skills and the reference group in relation to emotional and behavioral problems. Multinomial logistic regression analysis was used to verify the association between mental health (outcome variable) and independent variables - motor proficiency and sex. The choice to use this analysis is justified by the fact that the result has more than two categories - normal, borderline, and abnormal development - using individuals with normal development as a reference. Odds ratio estimates (OR) and 95% confidence intervals (95% CI) were also obtained. First, a crude analysis was performed, followed by an analysis adjusted by sex. In all analyses, the significance level of 5% was adopted, using the statistical program Statistical Package for the Social Sciences - SPSS, version 20.0.

## **Results**

Regarding the characterization of the participants (Table 1), it was possible to observe that the percentage of participants classified as presenting abnormal development, in relation to emotional and behavioral problems, was higher in children with poor motor skills (46.7%).

**Table 1.** Characterization of the participants

VARIABLES	TOTAL n= (%)	Poor motor skills n= (%)	Reference group n= (%)	$\chi^2$	p- value
<b>Sex</b>				7.61	.004
Male	152(44.9)	52 (53.8)	100(64.5)		
Female	187(55.1)	39(46.2)	148(75.2)		
<b>Total difficulties</b>				27.52	<.001
Normal development	192(56.8)	31(34.8)	161(64.9)		
Borderline	52(15.3)	17(18.5)	35(14.1)		
Abnormal development	95(27.9)	43(46.7)	52(21.0)		

**Note:**  $\bar{x}$ = mean; SD= standard deviation; U= Mann Whitney U test value n = absolute frequency;  $\chi^2$ = value of the chi-square test

**Source:** The authors

Table 2 presents the associations between emotional and behavioral problems with motor proficiency and sex. According to the results of the crude analysis, it was possible to observe an association between emotional symptoms, conduct problems, hyperactivity and inattention, relationship problems with peers, and total difficulties related to mental health with motor proficiency and sex. When adjusting the analysis, some variables remained associated with the outcome, and children with poor motor skills, when compared to children in the reference group presented 1.94 (95%CI=1.08-3.49) more chances of presenting abnormal development with regard to emotional symptoms; 3.23 (95%CI=1.59-6.56) more chances of having borderline and abnormal development with regard to conduct problems, respectively; 2.53(95%CI=1.07-5.97) and 3.31(95%CI=1.92-5.68) more chances of having borderline and abnormal development with regard to hyperactivity and inattention symptoms, respectively. Finally, children with poor motor skills had 3.09 (1.59-6.00) more chances of having relationship problems with peers, and 4.16 (95%CI=2.39-7.24) and 3.83(95%CI= 2.18-6.72) more chances of having greater difficulties related to emotional and behavioral symptoms, respectively. In addition, boys, when compared to girls, were 1.74 (95%CI=1.02-2.98), 2.15(95%CI=1.29-3.58), and 2.15(1, 27-3,62) times more likely to present abnormal development in relation to conduct problems, hyperactivity and inattention, and total difficulties related to emotional and behavioral symptoms, respectively.

**Table 2.** Association of motor skills and sex with emotional symptoms, conduct problems, hyperactivity and inattention

Variables	EMOTIONAL SYMPTOMS			
	Borderline development OR (95% CI)	Abnormal development OR (95% CI)	Borderline development OR (95% CI)	Abnormal development OR (95% CI)*
<b>Motor proficiency</b>				
Reference group	1	1	1	1
Low motor skills	1.83(.95-3.52)	<b>1.87(1.05-3.33)</b>	1.84(.95-3.58)	<b>1.94(1.08-3.49)</b>
<b>Sex</b>				
Female	1	1	1	1
Male	1.03(.56-1.90)	.87(.51-1.48)	.95(.51-1.76)	.79(0.46-1.36)
Variables	CONDUCT PROBLEMS			
	Borderline development OR (95% CI)	Abnormal development OR (95% CI)	Borderline development OR (95% CI)	Abnormal development OR (95% CI)*
<b>Motor proficiency</b>				
Reference group	1	1	1	1
Low motor skills	<b>3.33(1.65-6.73)</b>	<b>2.96(1.68-5.20)</b>	<b>3.23(1.59-6.56)</b>	<b>2.74(1.55-4.85)</b>
<b>Sex</b>				
Female	1	1	1	1
Male	1.43(.73-2.81)	<b>1.95(1.16-3.29)</b>	1.26(.63-2.50)	<b>1.74(1.02-2.98)</b>
Variables	HIPERATIVIDADE E DESATENÇÃO			
	Borderline development OR (95% CI)	Abnormal development OR (95% CI)	Borderline development OR (95% CI)	Abnormal development OR (95% CI)*
<b>Motor proficiency</b>				
Reference group	1	1	1	1
Low motor skills	<b>2.63(1.12-6.17)</b>	<b>3.61(2.12-6.15)</b>	<b>2.53(1.07-5.97)</b>	<b>3.31(1.92-5.68)</b>
<b>Sex</b>				
Female	1	1	1	1
Male	1.52(.68-3.39)	<b>2.41(1.47-3.95)</b>	1.39(.62-3.15)	<b>2.15(1.29-3.58)</b>

**Note:** CI95%: 95% confidence interval; OR: *Odds Ratio*; \* OR: *Odds Ratio* adjusted for sex; bold indicates statistical significance

**Source:** The authors

**Table 3.** Association of motor skills and sex with peer relationships, pro-social behavior, and total difficulties

	RELATIONSHIP WITH PEERS			
	Borderline development OR (95% CI)	Abnormal development OR (95% CI)	Borderline development OR (95% CI)	Abnormal development OR (95% CI)*
<b>Motor proficiency</b>				
Reference group	1	1	1	1
Low motor skills	1.77(.85-3.72)	<b>3.30(1.71-6.35)</b>	1.77(.84-3.75)	<b>3.09(1.59-6.00)</b>
<b>Sex</b>				
Female	1	1	1	1
Male	1.01(.56-1.83)	<b>1.76(1.04-2.98)</b>	.96(.53-1.75)	1.57(.92-2.68)
	PRO-SOCIAL BEHAVIOR			
	Borderline development OR (95% CI)	Abnormal development OR (95% CI)	Borderline development OR (95% CI)	Abnormal development OR (95% CI)*
<b>Motor proficiency</b>				
Reference group	1	1	1	1
Low motor skills	1.76(.56-5.55)	1.76(.56-5.55)	1.44(.45-4.63)	1.58(.49-5.06)
<b>Sex</b>				
Female	1	1	1	1
Male	1.47(.75-16.58)	2.14(.68-6.71)	1.77(.84-3.75)	2.02(.63-6.39)
	TOTAL DIFFICULTIES			
	Borderline development OR (95% CI)	Abnormal development OR (95% CI)	Borderline development OR (95% CI)	Abnormal development OR (95% CI)*
<b>Motor proficiency</b>				
Reference group	1	1	1	1
Low motor skills	<b>2.44(1.23-4.88)</b>	<b>2.22(1.10-4.50)</b>	<b>4.16(2.39-7.24)</b>	<b>3.83(2.18-6.72)</b>
<b>Sex</b>				
Female	1	1	1	1
Male	<b>2.50(1.34-4.68)</b>	<b>2.35(1.25-4.42)</b>	<b>2.42(1.46-4.00)</b>	<b>2.15(1.27-3.62)</b>

**Note:** 95%CI: 95% confidence interval; OR: *Odds Ratio*; \* OR: *Odds Ratio* adjusted for sex; bold indicates statistical significance

**Source:** The authors

## Discussion

The objective of the current study was to investigate the association of emotional and behavioral problems with skills and sex in students aged 7 to 10 years. Among the main findings, we observed that children with poor motor skills were more likely to present abnormal development with regard to emotional problems - symptoms of anxiety and depression and relationship problems with peers - behavioral problems- conduct problems and symptoms of hyperactivity and inattention - and also with regard to total difficulties, when compared to children from the reference group. Furthermore, boys were more likely to present abnormal development in relation to behavioral problems and total difficulties, when compared to girls.

With regard to emotional problems, our results corroborate the study by Van Den Heuvel, Jansen, Reijneveld, Flapper, and Smits-Englesman<sup>26</sup> conducted with 402 children aged 4 to 10 years, in which teachers pointed out that 36% of children with poor motor skills presented emotional problems. Likewise, a longitudinal study pointed out that motor problems at 7 years of age can predict emotional symptoms at 17 years of age<sup>27</sup>, indicating that problems with motor proficiency and the consequences on mental health persist until the end of adolescence. However, despite the results found in the current study, it is not possible to assume a causal relationship between emotional problems and motor proficiency, as it is assumed that deficient motor skills and emotional symptoms, such as anxiety and depression, may be interrelated with other factors.

In addition, children with poor motor skills were more likely to present problems with peer relationships. Wagner, Jecauc, Worth, and Woll<sup>28</sup>, suppose that poor motor skills can cause social relationship problems, agreeing with our results. Similarly, teachers report that children with poor motor skills generally have fewer friends and are more socially isolated than their peers<sup>29</sup>. Thus, it is speculated that poor motor skills make access to opportunities for playing and games difficult, and consequently act as a barrier to interaction and socialization, considering that social skills are critical for success in peer relationships. There is evidence to suggest that when the child has no chance of forming bonds with peers, their ability to regulate emotions and form relationships is negatively affected, impairing their social development<sup>30,5</sup>.

Our results also found that children with poor motor skills were more likely to present behavioral problems - symptoms of hyperactivity and inattention, and conduct problems. Several studies point to similar results, relating Developmental Coordination Disorder to Attention Deficit Hyperactivity Disorder<sup>31,32</sup>. Although none of the children in our sample have any confirmed clinical diagnosis of these two disorders, poor motor skills were associated with symptoms of hyperactivity and inattention. Kaiser, Schoemaker, Albaret, and Geuze<sup>33</sup>, provide a possible explanation for this relationship, suggesting that the lack of attention is a mechanism underlying the deficit in motor skills, that is, poor motor skills are due to the lack of attention.

Regarding conduct problems, these were also associated with poor motor skills. Similarly, in the study by Salamanca, Naranjo, Plata, and Velasco<sup>34</sup>, with Colombian children aged 6 to 12, conduct problems were more frequent in children with poor motor skills. To date, no plausible explanation has been found for these data, however, it is believed that there may be neurophysiological relationships that connect motor behavior to the executive functions linked with conduct and behavior<sup>12</sup>. Thus, it is suggested that future studies investigate these possible relationships.

In addition, it was found that boys were more likely to present behavioral problems, as well as total difficulties. These results are in accordance with the literature, which points out that behavioral problems are more common in boys than in girls, affecting approximately 12% of boys and 7% of girls throughout life<sup>35</sup>, as well as which, total difficulties are also more prevalent in boys (4.5%) than in girls (3,4%)<sup>36</sup>. These results can be interpreted in two ways: first, it is argued that in the current study 53.8% of the boys presented an association with poor motor skills, which may have contributed to more behavioral problems, in view of this relationship; second, according to Basterra et al.<sup>37</sup> the differences between the sexes can be attributed to cultural issues, which are more demanding on males and more indifferent to female behavior, leading to behavioral problems being more typical in boys.

Finally, our results are consistent with other studies that evaluated emotional and behavioral problems in children with Developmental Coordination Disorder. In the study by Green et al.<sup>17</sup>, Van den Heuvel et al.<sup>26</sup>, and Crane et al.<sup>32</sup>, the authors found high rates of total difficulties, as well as in the subscales, in children aged 7 to 10 years. However, from the

current research, it is possible to notice that these difficulties extend to normative samples, indicating that this association is not limited to clinical groups.

Currently, the literature does not justify the reasons that lead children with poor motor skills to develop mental health problems<sup>38, 39</sup>. However, the theoretical model of the Environmental Stress Hypothesis, suggests that motor proficiency is a primary stressor, which can expose the child to multiple secondary stressors, such as relationship problems with peers, lack of involvement in physical activity, low self-perception, and low quality of life, which contribute to emotional symptoms<sup>38,40-43</sup>. In addition, it is believed that behavioral problems themselves can mediate the relationship between motor proficiency and emotional problems. Finally, further studies are needed to establish causal relationships between motor skills and emotional and behavioral problems, so that the possible interdependence relationship between these variables can be analyzed in a deeper way.

It is important to note that these results are based on responses provided by parents or guardians, due to their subjective perception of their children's behavior. Caçola and Killian<sup>44</sup>, highlight that parents can gain a greater perception of problems than children. Thus, it is suggested that future studies try different sources - teachers and the child himself, so that the results presented in this study can be further supported by the literature.

Thus, the current study contributes to the literature, in the sense that it confirms the hypothesis that emotional and behavioral problems are related to poor motor proficiency and highlights that even though they are two different constructs, both refer to mental health problems and can support the great variability of difficulties that children with poor motor skills may face. It is also important to highlight the investigation of non-clinical samples, showing that children, in general, suffer from symptoms that can be considerably uncomfortable, capable of negatively affecting mental health. Finally, the data presented and analyzed herein corroborate previous literary suggestions that motor proficiency is an extremely important factor in child development, and perhaps in the evolution of the human social organization in epigenetic and social terms.

## Conclusion

The current study concluded that having poor motor skills and being male are associated with emotional and behavioral problems in schoolchildren aged 7 to 10 years. Empirical data such as these can help raise public and professional awareness, making it even more relevant to address this phenomenon, in view of the social and psychological consequences, in addition to the individual costs arising from mental health problems. Thus, the school community and especially Physical Education teachers, can feel more able to contribute emphatically, creating strategies so that children with poor motor skills are more stimulated, which can positively influence the development of these students in different cultural contexts.

## References

1. Organização Mundial da Saúde [Internet]. MI-GAP Manual de Intervenções: Programa de Ação Mundial em Saúde Mental para transtornos mentais, neurológicos e por uso de álcool e outras drogas na rede de atenção básica à saúde. Genebra: World Health Organization, 2010 [Cited on 21 Set 2020]. Available from: [https://www.who.int/mental\\_health/publications/IG\\_portuguese.pdf](https://www.who.int/mental_health/publications/IG_portuguese.pdf)
2. Bordin IAS, Offord DR. Transtorno da conduta e comportamento anti-social. *Braz J Psychiatry* 2000;22:12-15. Doi: <https://doi.org/10.1590/S1516-4446200000600004>

3. Ferriolli SHT, Marturano EM, Puntel LP. Contexto familiar e problemas de saúde mental infantil no Programa Saúde da Família. *Rev Saude Publica* 2007;41:251-259. Doi: <https://doi.org/10.1590/s0034-89102006005000017>
4. Silva TBF, Osório FL, Loureiro SR. SDQ: discriminative validity and diagnostic potential. *Front psychol* 2015;6:811. Doi: <https://doi.org/10.3389/fpsyg.2015.00811>
5. Sloan S, Winter K, Connolly P, Gildea A. The effectiveness of Nurture Groups in improving outcomes for young children with social, emotional and behavioural difficulties in primary schools: An evaluation of Nurture Group provision in Northern Ireland. *Child Youth Serv Rev* 2020;108:104619. Doi: <https://doi.org/10.1016/j.childyouth.2019.104619>
6. Rigoli D, Piek JP. Motor Problems as a risk factor for poorer mental health in children and adolescents: What do we know and should we be screening for psychological difficulties in those with poor motor skills?. *Curr Dev Disord Rep* 2016;3(3):190-194. Doi: <https://doi.org/10.1007/s40474-016-0091-9>
7. Li YC, Kwan MY, Cairney J. Motor coordination problems and psychological distress in young adults: A test of the Environmental Stress Hypothesis. *Res Dev Disabil* 2019; 84: 112-121.
8. Robinson LE, Stodden DF, Barnett LM, Lopes VP, Logan, SW, Rodrigues LP, D'Hondt E. Motor competence and its effect on positive developmental trajectories of health. *Int. J. Sports Med* 2015; 45(9), 1273-1284.
9. True L, Pfeiffer KA, Dowda M, Williams HG, Brown WH, O'Neill JR, Pate RR. Motor competence and characteristics within the preschool environment. *J Sci Med Sport* 2017; 20(8), 751-755.
10. Lingam R, Jongmans MJ, Ellis M, Hunt LP, Golding J, Emond A. Mental health difficulties in children with developmental coordination disorder. *Pediatrics* 2012; 129(4), e882-e91. Doi: <https://doi.org/10.1542/peds.2011-1556>
11. Ferguson GD, Jelsma J, Versfeld P, Smits-Engelsman BCM. Using the ICF framework to explore the multiple interacting factors associated with developmental coordination disorder. *Curr Dev Disord Rep* 2014; 1(2), 86-101. Doi: <https://doi.org/10.1007/s40474-014-0013-7>
12. Zwicker JG, Missiuan C, Harris SR, Boyd LA. Brain activation associated with motor skill practice in children with developmental coordination disorder: an fMRI study. *Int J Dev Neurosci* 2011;29: 145-152. Doi: <https://doi.org/10.1016/j.ijdevneu.2010.12.002>
13. Chen H, Cohn ES. Social participation for children with developmental coordination disorder: conceptual, evaluation and intervention considerations. *Phys Occup Ther Pediatr* 2003;23(4):61-78. doi: [https://doi.org/10.1080/J006v23n04\\_05](https://doi.org/10.1080/J006v23n04_05)
14. Missiuna C, Moll S, King G, Stewart D, Macdonald K. Life experiences of young adults who have coordination difficulties. *Can J Occup Ther* 2008;75(3):157-166. Doi: <https://doi.org/10.1177/000841740807500307>
15. Poulsen AA, Ziviani JM, Cuskelly M, Smith R. Boys with developmental coordination disorder: Loneliness and team sports participation. *Am J Occup Ther* 2007;61(4):451-462. Doi: <https://doi.org/10.5014/ajot.61.4.451>
13. Pratt ML, Hill EL. Anxiety profiles in children with and without developmental coordination disorder. *Res Dev Disabil* 2011;32(4):1253-1259. Doi: <https://doi.org/10.1016/j.ridd.2011.02.006>
17. Green, D, Baird G, Sugden D. A pilot study of psychopathology in developmental coordination disorder. *Child Care Health Dev* 2006;32(6):741-750. Doi: <https://doi.org/10.1111/j.1365-2214.2006.00684.x>
18. Hill LJ, Mushtaq F, O'Neill L, Flatters I, Williams JH, Mon-Williams M. The relationship between manual coordination and mental health. *Eur Child Adolesc Psychiatry* 2006;25(3):283-295. Doi: <https://doi.org/10.1007/s00787-015-0732-2>
19. Goulardins JB, Rigoli D, Licari M, Piek JP, Hasue RH, Oosterlaan J, et al.. Attention deficit hyperactivity disorder and developmental coordination disorder: Two separate disorders or do they share a common etiology. *Behav Brain Res* 2015;292:484-492. doi: <https://doi.org/10.1016/j.bbr.2015.07.009>
20. Henderson SE, Sugden DA, Barnett AL. Movement Assessment Battery for Children-2. (MABC-2). Examiner's manual. London: Harcourt Assessment; 2007.
21. Izadi-Najafabadi S, Ryan N, Ghafooripoor G, Gill K, Zwicker JG. Participation of children with developmental coordination disorder. *Res Dev Disabil* 2019;84:75-84. Doi: <https://doi.org/10.1016/j.ridd.2018.05.011>
22. Karras HC, Morin DN, Gill K, Izadi-Najafabadi S, Zwicker JG. Health-related quality of life of children with developmental coordination disorder. *Res Dev Disabil* 2019;84:85-95. Doi: <https://doi.org/10.1016/j.ridd.2018.05.012>
23. Goodman R. The Strengths and Difficulties Questionnaire: a research note. *J Child Psychol Psychiatry* 1997; 38(5):581-586. Doi: <https://doi.org/10.1111/j.1469-7610.1997.tb01545.x>
24. Fleitlich B, Goodman R. Social factors associated with child mental health problems in Brazil: cross sectional survey. *Bmj* 2001;323(7313):599-600. Doi: <https://doi.org/10.1136/bmj.323.7313.599>

25. Woerner W, Fleitlich-Bilyk B, Martinussen R, Fletcher J, Cucchiaro G, Dalgalarrrond P, et al. The Strengths and Difficulties Questionnaire overseas: evaluations and applications of the SDQ beyond Europe. *Eur Child Adolesc Psychiatry* 2004;13(2):ii47-ii54. Doi: <https://doi.org/10.1007/s00787-004-2008-0>
26. Van den Heuvel M, Jansen DE, Reijneveld SA, Flapper BC, Smits-Engelsman BC. Identification of emotional and behavioral problems by teachers in children with developmental coordination disorder in the school community. *Res Dev Disabil* 2016;51:40-48. Doi: <https://doi.org/10.1016/j.ridd.2016.01.008>
27. Rasmussen P, Gillberg C. Natural outcome of ADHD with developmental coordination disorder at age 22 years: a controlled, longitudinal, community-based study. *J Am Acad Child Adolesc Psychiatry* 2000; 39(11):1424-31. Doi: <https://doi.org/10.1097/00004583-200011000-00017>
28. Wagner M, Jekauc D, Worth A, Woll A. Elaboration of the environmental stress hypothesis—results from a population-based 6-year follow-up. *Front Psychol* 2016;7:1904. doi: <https://doi.org/10.3389/fpsyg.2016.01904>
29. Piek JP, Barrett NC, Allen LS, Jones A, Louise M. The relationship between bullying and self-worth in children with movement coordination problems. *Br J Educ Psychol* 2005;75(Pt 3): 453-463. Doi: <https://doi.org/10.1348/000709904X24573>
30. Linsell L, Johnson S, Wolke D, Morris J, Kurinczuk JJ, Marlow N. Trajectories of behavior, attention, social and emotional problems from childhood to early adulthood following extremely preterm birth: a prospective cohort study. *Eur Child Adolesc Psychiatry* 2019;28(4):531-42. Doi: <https://doi.org/10.1007/s00787-018-1219-8>
31. Kadesjö B, Gillberg C. Attention deficits and clumsiness in Swedish 7-year-old children. *Dev Med Child Neurol* 1998;40(12):796-804. Doi: <https://doi.org/10.1111/j.1469-8749.1998.tb12356.x>
32. Crane L, Sumner E, Hill EL. Emotional and behavioural problems in children with Developmental Coordination Disorder: Exploring parent and teacher reports. *Res Dev Disabil* 2017;70:67-74. Doi: <https://doi.org/10.1016/j.ridd.2017.08.001>
33. Kaiser ML, Schoemaker MM, Albaret JM, Geuze RH. What is the evidence of impaired motor skills and motor control among children with attention deficit hyperactivity disorder (ADHD)? Systematic review of the literature. *Res Dev Disabil* 2015;36:338-357. Doi: <https://doi.org/10.1016/j.ridd.2014.09.023>
34. Salamanca LM, Naranjo MM, Plata LMD, Velasco RIS. Estudio de asociación del trastorno del desarrollo de la coordinación con los problemas de conducta en niños de la ciudad de Bucaramanga, Colombia. *Rev Cienc de la Salud* 2016;14(3):351-363. Doi: <https://doi.org/10.12804/revsalud14.03.2016.04>
35. De Psiquiatria, Associação Americana. APA. Manual diagnóstico e estatístico de transtornos mentais—texto revisado. DSM-V. Porto Alegre: Artmed Editora. 2013.
36. Basterra V. Porcentaje de población infantojuvenil española con problemas psicoemocionales y sus diferencias entre 2006 y 2012. *Med Clin (Barc)* 2016;147(9):393-396. Doi: <https://doi.org/10.1016/j.medcli.2016.07.019>
37. Biederman J, Mick E, Faraone S V, Braaten E, Doyle A, Spencer T, et al. Influence of gender on attention deficit hyperactivity disorder in children referred to a psychiatric clinic. *Am J Psychiatry* 2002;159(1):36-42. Doi: <https://doi.org/10.1176/appi.ajp.159.1.36>
38. Cairney J, Rigoli D, Piek J. Developmental coordination disorder and internalizing problems in children: the environmental stress hypothesis elaborated. *Dev Rev* 2013;33(3):224-238. Doi: <https://doi.org/10.1016/j.dr.2013.07.002>
39. Missiuna C, Cairney J, Pollock N, Campbell W, Russell DJ, Macdonald K., et al. Psychological distress in children with developmental coordination disorder and attention-deficit hyperactivity disorder. *Res Dev Disabil* 2014;35(5):1198-1207. Doi: <https://doi.org/10.1016/j.ridd.2014.01.007>
40. Li YC, Kwan MY, Cairney J. Motor coordination problems and psychological distress in young adults: A test of the Environmental Stress Hypothesis. *Res Dev Disabil* 2019;84:112-121. Doi: <https://doi.org/10.1016/j.ridd.2018.04.023>
41. Li YC, Kwan MY, King-Dowling S, Rodriguez MC, Cairney J. Does physical activity and BMI mediate the association between DCD and internalizing problems in early childhood? A partial test of the Environmental Stress Hypothesis. *Hum Mov Sci*, 2021;75:102744. Doi: <https://doi.org/10.1016/j.humov.2020.102744>
42. Mancini VO, Rigoli D, Roberts LD, Heritage B, Piek JP. The relationship between motor skills and psychosocial factors in young children: A test of the elaborated environmental stress hypothesis. *Br J Educ Psychol* 2018;88(3):363-379. Doi: <https://doi.org/10.1111/bjep.12187>
43. Li YC, Kwan MY, Clark HJ, Hay J, Faught BE, Cairney J. A test of the Environmental Stress Hypothesis in children with and without Developmental Coordination Disorder. *Psychol Sport Exerc* 2018;37:244-250. Doi: <https://doi.org/10.1016/j.psychsport.2017.11.001>

44. Caçola P, Killian M. Health-related quality of life in children with developmental coordination disorder: association between the PedsQL and KIDSCREEN instruments and comparison with their normative samples. *Res Dev Disabil* 2018;75:32-39. Doi: <https://doi.org/10.1016/j.ridd.2018.02.009>

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**ORCID** number:

Pâmella Medeiros: <https://orcid.org/0000-0001-9509-940X>

Marcela Almeida Zequinão: <https://orcid.org/0000-0003-3570-5425>

Walan Robert Silva: <https://orcid.org/0000-0003-0568-4272>

Isabely Rúbila Maciel :<https://orcid.org/0000-0003-0116-5627>

Fernando Luiz Cardoso: <https://orcid.org/0000-0002-3074-0988>

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**Correspondence address:** Pâmella de Medeiros. Rua Pascoal Simone , 358 - Coqueiros, Florianópolis - SC, 88080-350 E-mail: [pamellademedeiros@hotmail.com](mailto:pamellademedeiros@hotmail.com)